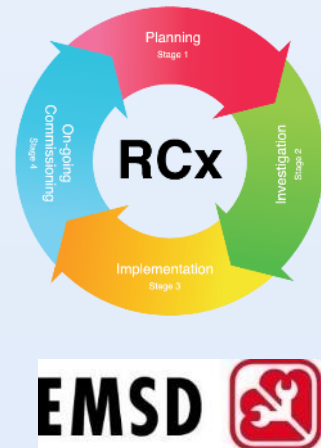


# Green School 2.0 for RCx – Professional Talks

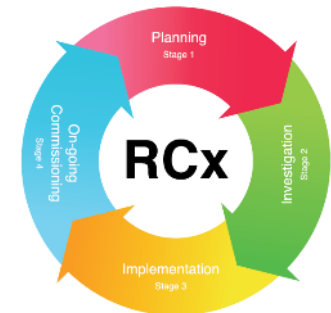
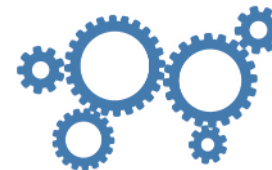
## Introduction of EMSD Technical Guidelines on Retro-commissioning (RCx)

2 December 2020



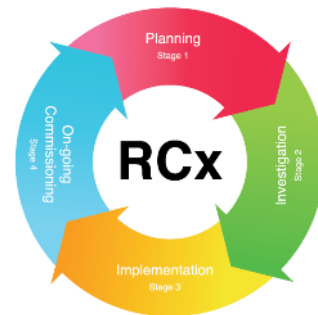
# Outline

1. Background of Hong Kong
2. Development of RCx
3. Support for RCx



# Background of Hong Kong


1






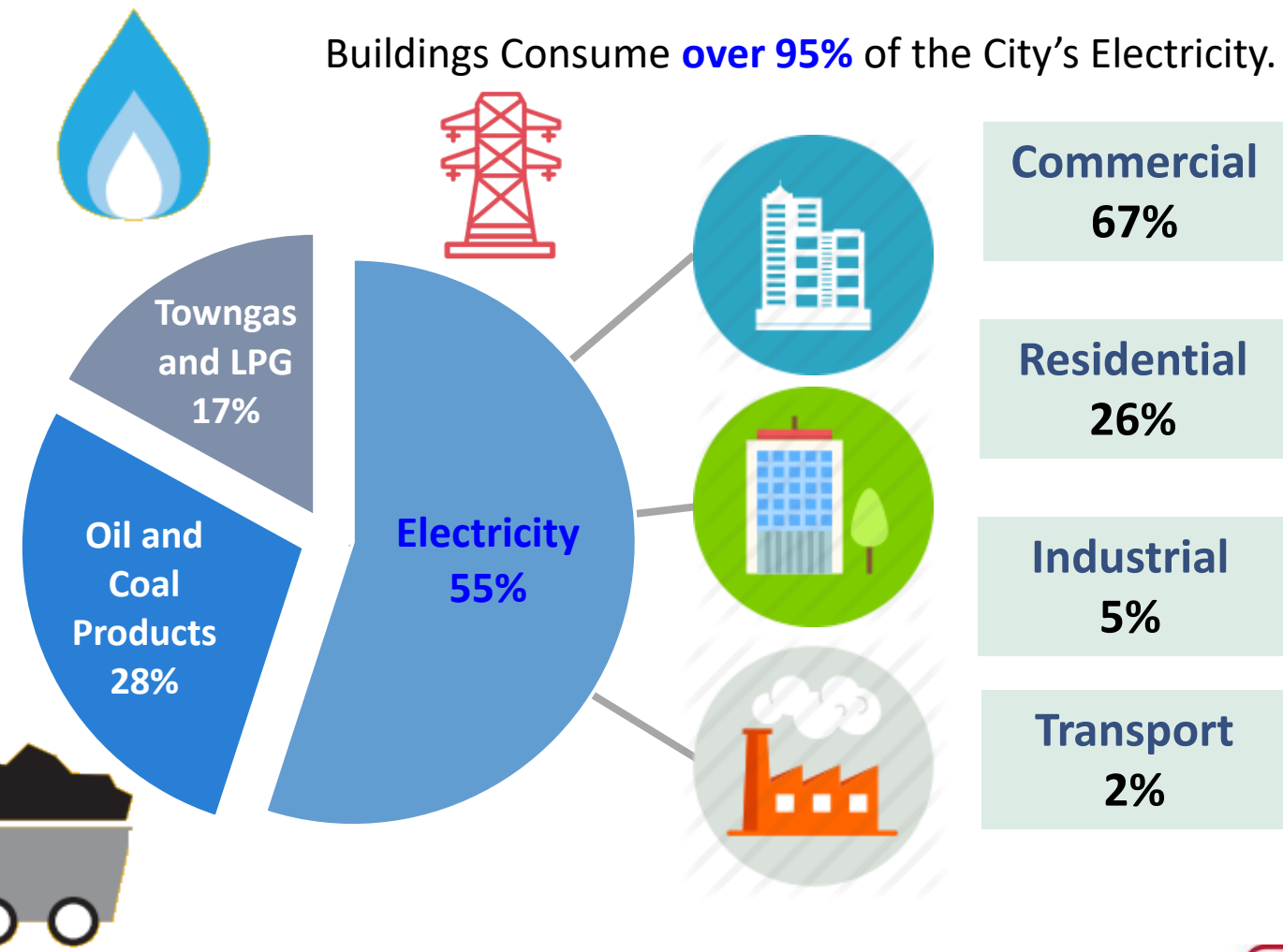
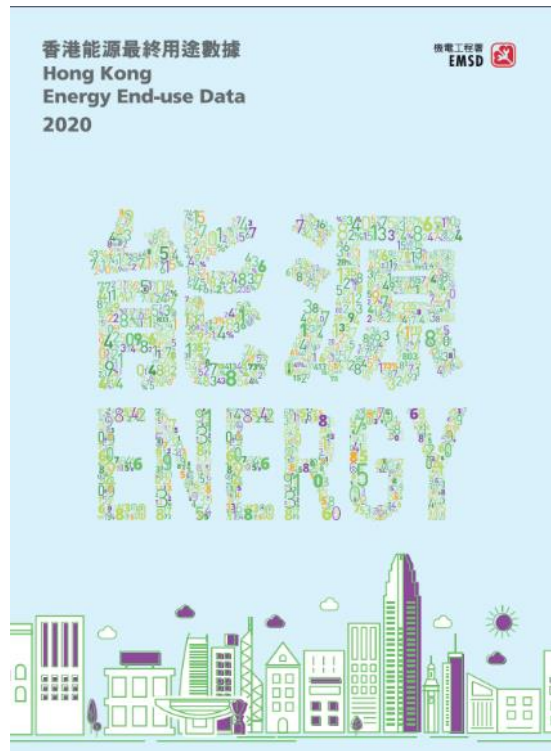
# Situation of Hong Kong & Energy Consumption in HK

Population  
**7.5 million**



Gov. & Private Buildings  
**8000+ 42000+**





Source: Hong Kong Energy End-use Data 2020, EMSD  
[censtatd.gov.hk/hkstat/sub/so20.jsp](http://censtatd.gov.hk/hkstat/sub/so20.jsp)

# Climate Action Plan 2030+ & Energy Saving Plan 2015~2025



**Carbon neutral  
by 2051 to 2100**

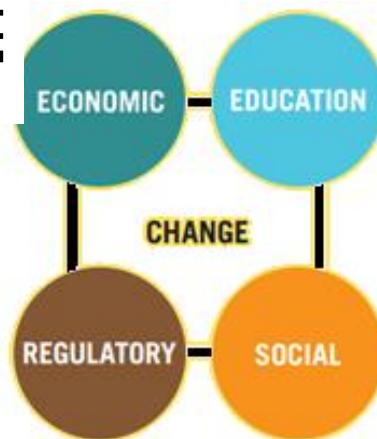


## ENERGY SAVING PLAN

Hong Kong's Built Environment  
2015~2025+



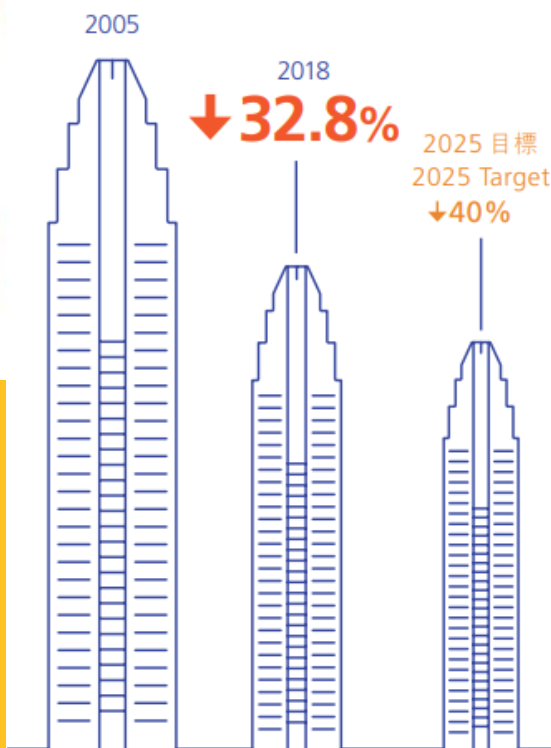
### Policy



Target  
Energy  
Intensity by  
**2025**



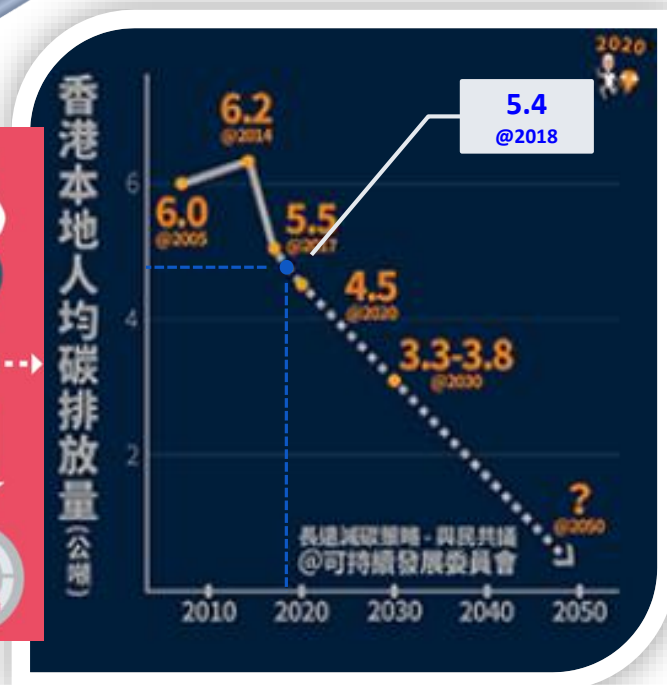
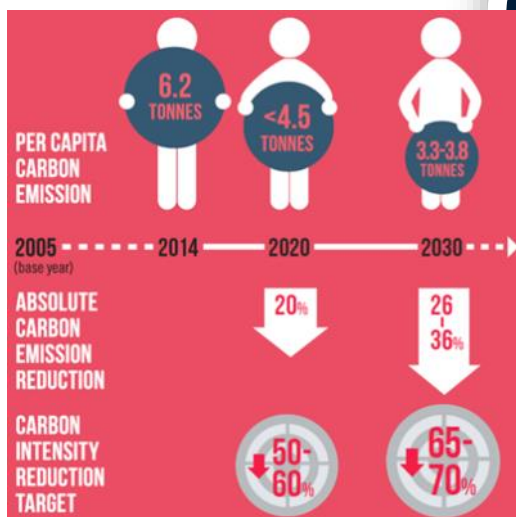
(base year  
2005)



# Policy Address 2020 – Striving towards Carbon Neutrality

**Carbon Emission**  
(2005 base year)

36%



**Carbon Neutrality**

Enhancing the energy efficiency of both new and existing buildings

Source: <https://www.enb.gov.hk/tc/sens-blog/blog20200421.html>

2020 Policy Address  
Climate Action Plan 2030+

# 4Ts Partnership

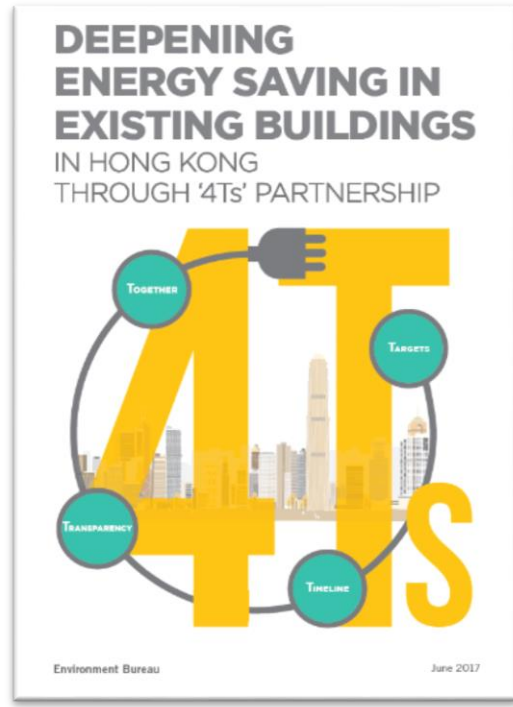
## 4Ts Operation Framework

3. Efforts made can be shown in appropriate metrics – ‘Transparency’

2. Set a carbon-related reduction ‘Timeline’

1. Set a carbon-related reduction ‘Target’

4. Everyone work ‘Together’





# 4Ts Partnership

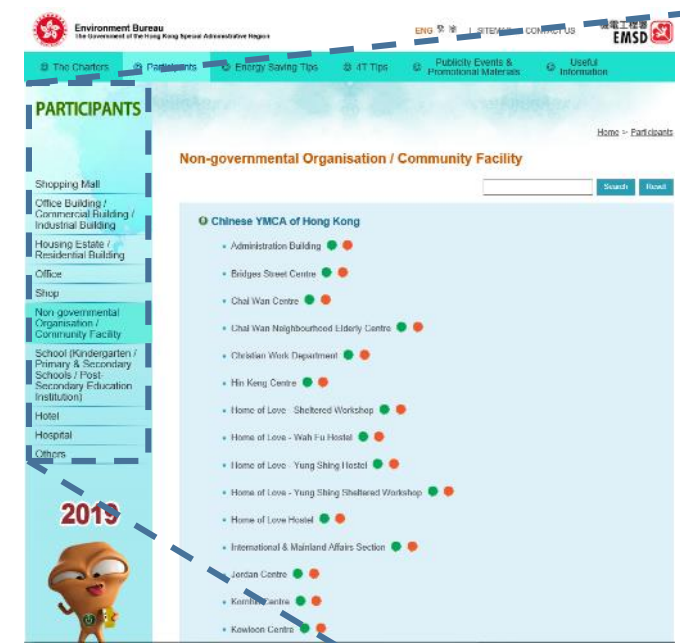
Relative **energy priorities**  
for buildings in HK

## Commercial & Institutional Buildings

- 1 Building design and structure
- 2 Occupants' behaviour
- 3 Appliances occupants choose to use



Equivalent to **20%** of  
electricity in HK

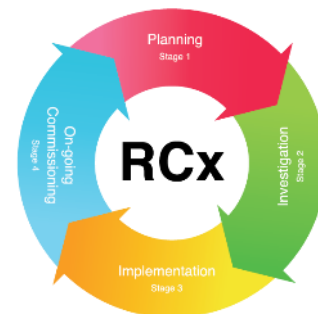


- ### PARTICIPANTS
- Shopping Mall
  - Office Building / Commercial Building / Industrial Building
  - Housing Estate / Residential Building
  - Office
  - Shop
  - Non-governmental Organisation / Community Facility
  - School (Kindergarten / Primary & Secondary Schools / Post-Secondary Education Institution)
  - Hotel
  - Hospital
  - Others



# Development of RCx

## 2



# Why we need Retro-commissioning?

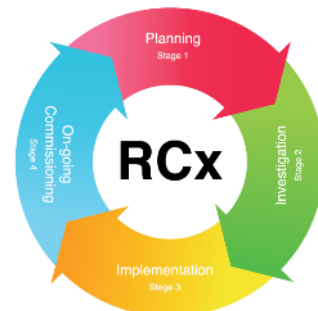


**Buildings often get out of tune...**

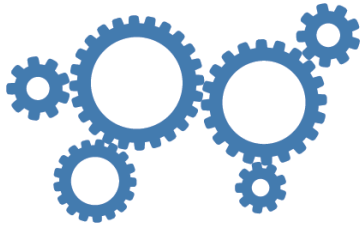
- Changes induced by addition, alterations and improvement works
- Drift off control set points
- Drop in accuracy or sensitivity of sensors and sub-optimal maintenance



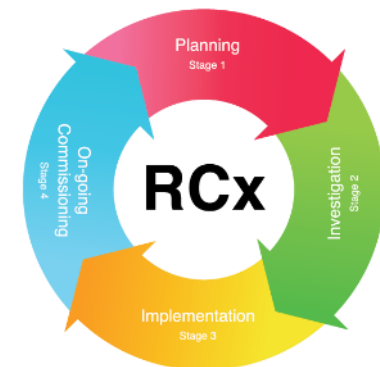
- Outdated control system
- Unsatisfactory performance of building
- Unnecessary energy losses



# What is Retro-commissioning?

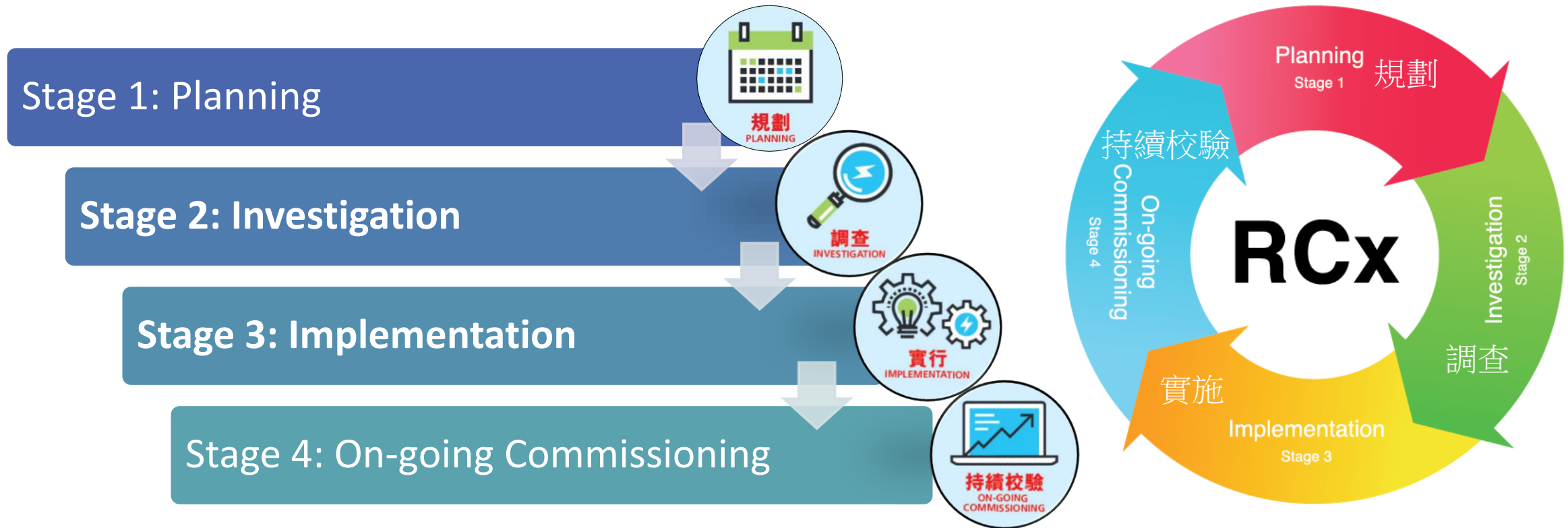


A cost-effective & systematic process to periodically check an existing building's performance.





# Working Stages of RCx



# Working Stages of RCx

## Stage 1: Planning



4 Feb 2021 (Thu)

Collect building design  
& operational  
information

Obtain facility  
requirement

**Carry out initial  
building walk-  
through**

**Collect energy  
consuming equipment  
energy information**

Preliminary Energy  
Saving Opportunities

Plan for site  
measurement & data  
verification



Gathering building  
information



Meeting with FMO

- Over Provision
- Unreasonably Condition [Human Comfort]
- Check Meter/Sensor Condition [Sufficient/Malfunction]
- Check Control Device Functionality [Malfunction]

- Operation Schedule
- Check Operation Range
- Control parameter & Set-Point



Site Walk & Check Sensor Condition



Review Facility  
requirement



# Working Stages of RCx

## Stage 2: Investigation



**Collect trend logged data & data analysis**

- Add meters and data logging facilities
- Take logs on the operation patterns

**Identify potential Energy Saving Opportunities (ESOs)**

- By checking unreasonable operation

Agreement of Measurement & Verification (M&V) Method for ESOs

Selection of ESOs for implementation



Current logger



Flow meter



IoT sensor



11 Dec 2020 (Fri)



4 Feb 2021 (Thu)





# Working Stages of RCx

## Stage 3: Implementation



### Implement Selected ESOs

Perform M&V

### Develop final report & ongoing commissioning

- Replacement faulty sensors and actuators
- System tuning and adjustment
- Equipment re-scheduling
- Addition of demand control facilities

- Ensure efficient operating performance
- Tracking energy and system performance
- Develop KPI and continuous monitoring KPI
- Conduct training for O&M staff



System fine tuning and adjustment



Replacing facility sensors



4 Feb 2021 (Thu)

# Working Stages of RCx

## Stage 4: On-going Commissioning



Report improvement



**Review / update O&M manual**



**Conduct training for O&M staff**



**Continuous monitoring & revise O&M plan for improved operation**

- Update KPI
- Calibration of sensor
- Update Control set-point

- Update the relevant information base on change of accommodation & operation



# Common Observation from RCx

## Example 1: Data log of temp & RH by IoT sensors

Unusual full day cooling

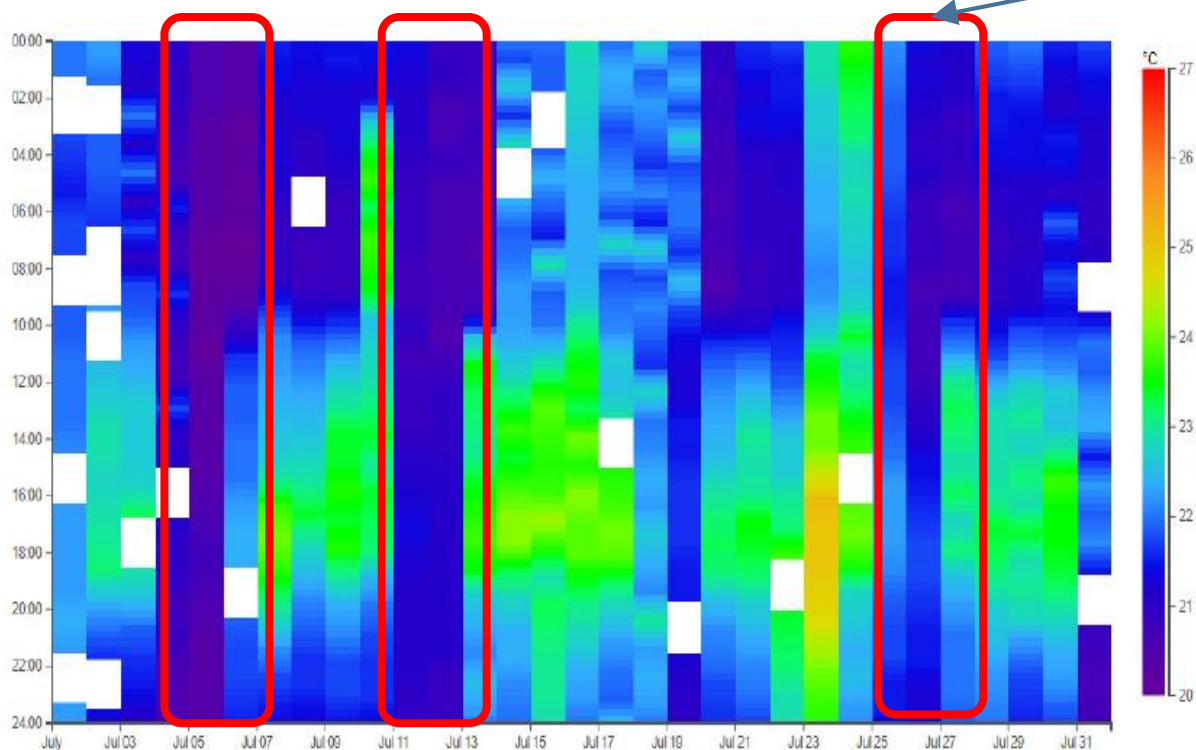


Figure. 1a Room Temperature in July

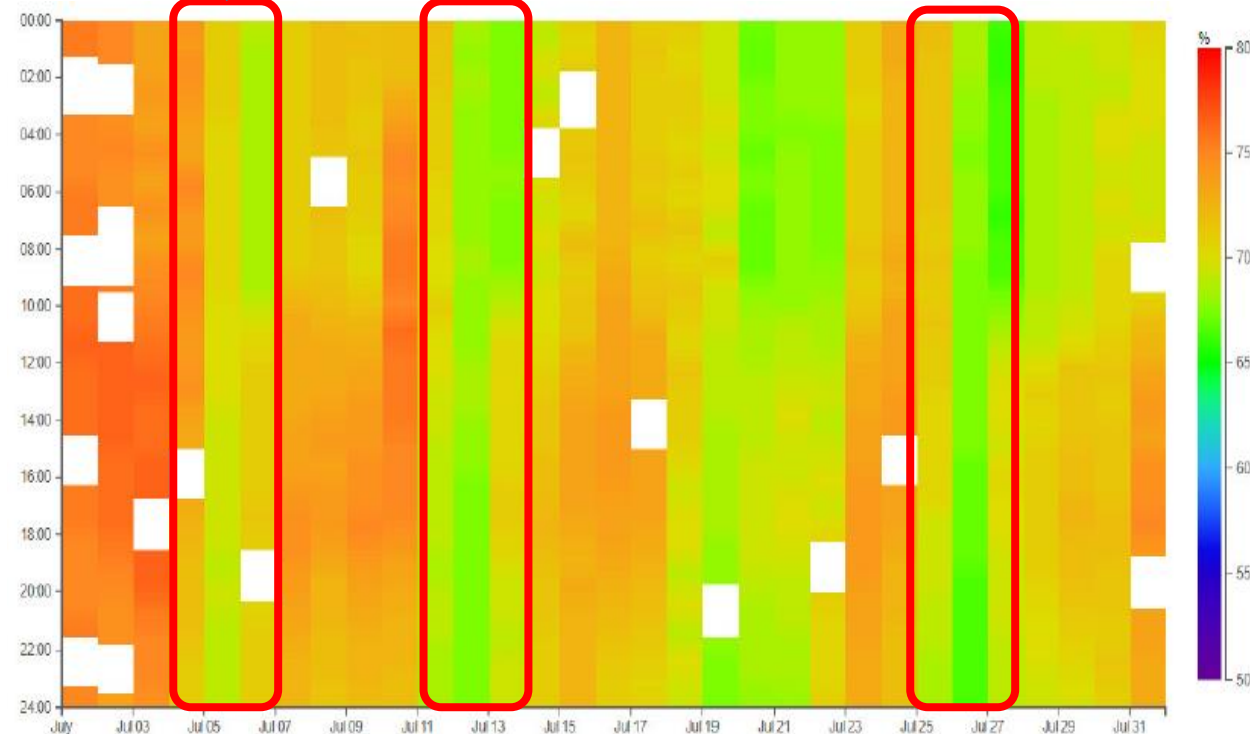


Figure. 1b Relative Humidity in July



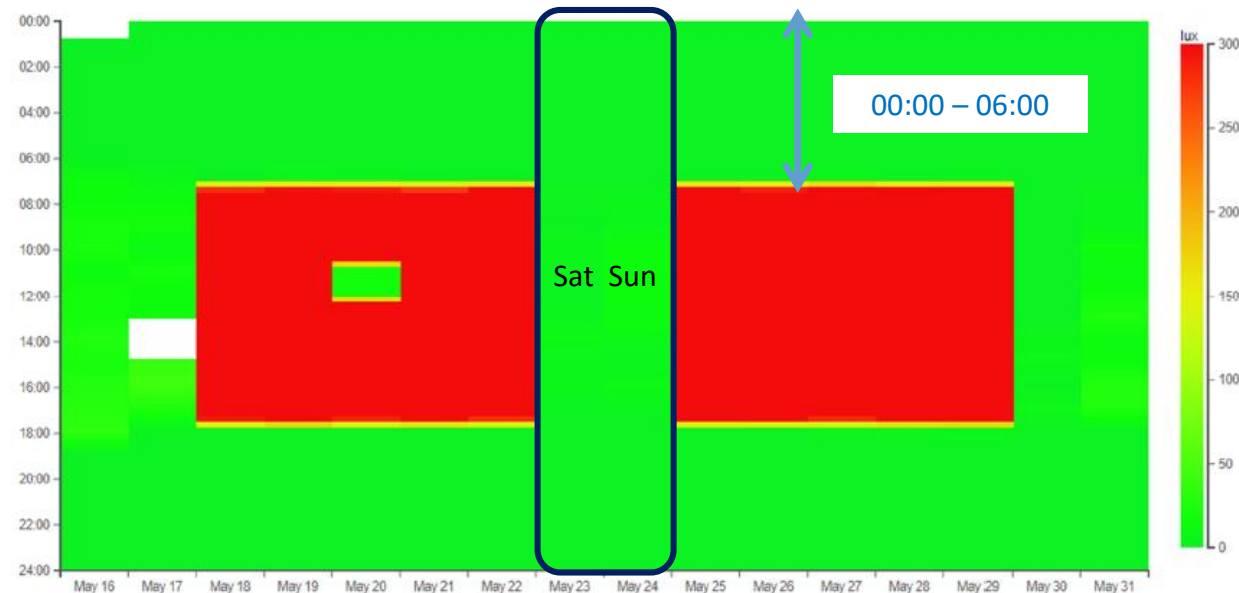
# Common Observation from RCx

## Example 2: Data log of lux level by IoT sensors

Unusual night operation

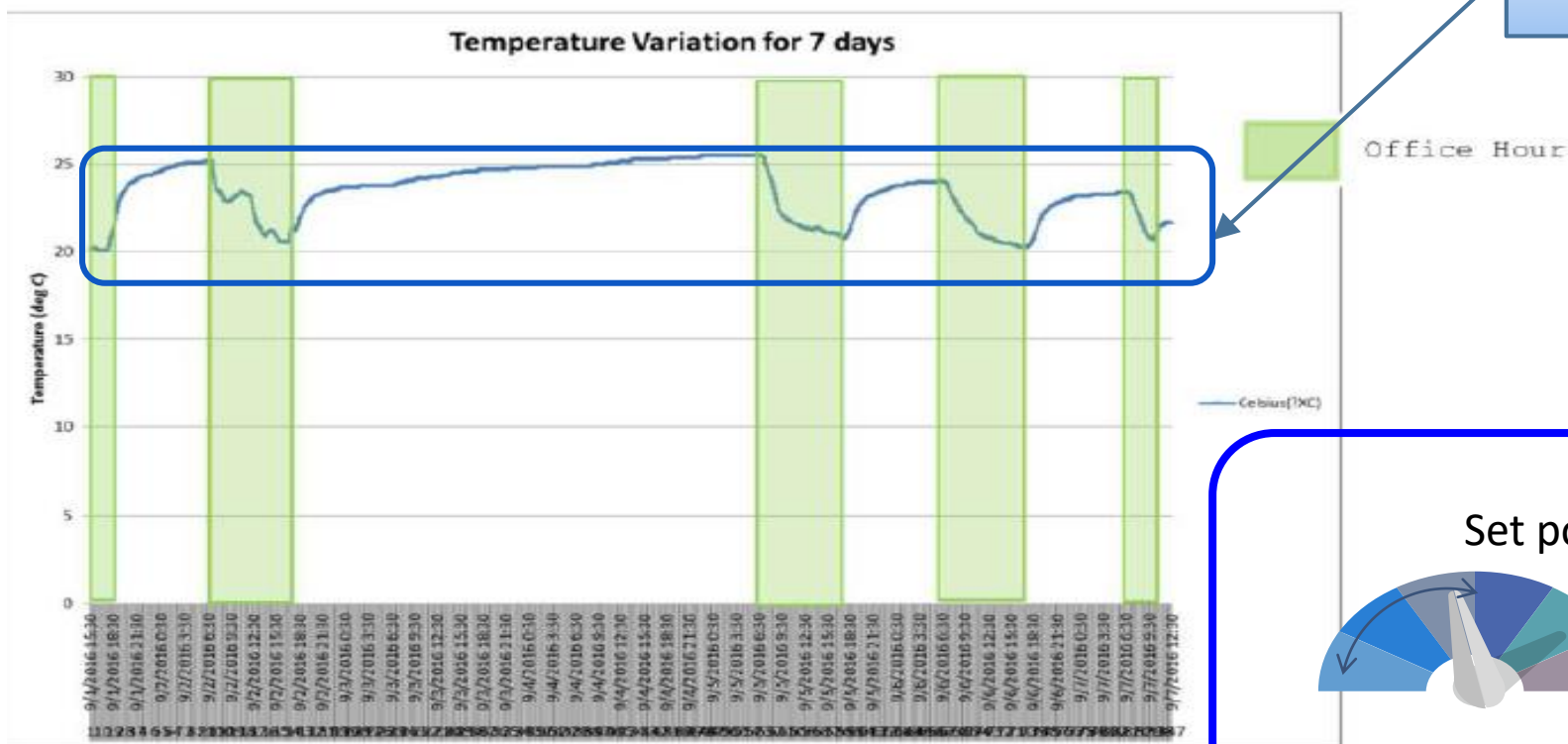


Unusual weekend operation

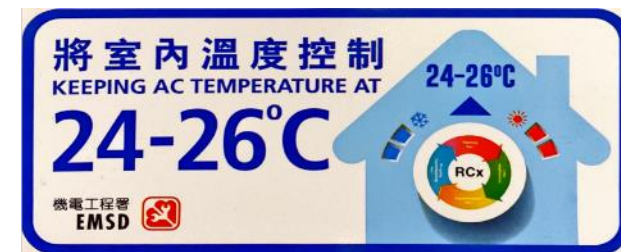
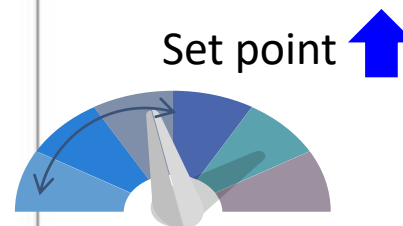


# Common Observation from RCx

## Example 3: Data log of room temp



Low room temperature in office hours

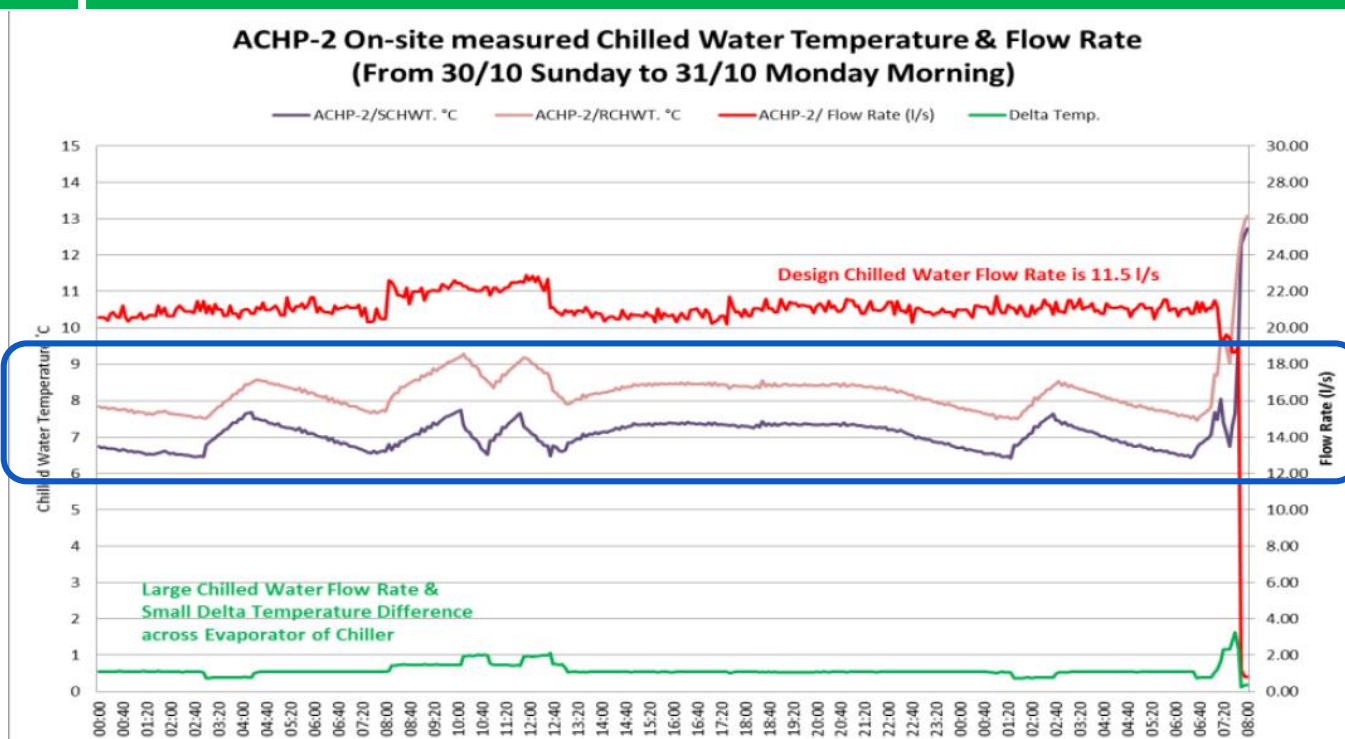


Adjust set point to meet operational and occupants' need

# Common Observation from RCx

## Example 4: Data log of chilled water flow and temperatures

Small  $\Delta T$  between CHWST & CHWRT  
Constant chilled water flow rate at non-office hours (part load condition)



Chiller On/ Off Schedule based on ambient temperature

Predicted Load, Ambient (°C)	≤ 700 Tons	> 700 Tons To ≤ 1800 Tons
≥ 26.0 °C	2 4 3 1A 1B 5	4 2 3 1B 1A 5
≥ 15.0 °C To < 26.0 °C	1A 1B 3 4 2 5	2 4 3 1A 1B 5
< 15.0 °C (Winter Mode)	1B 1A 2 4 3 5	1B 1A 2 4 3 5



# Benefits of RCx

**Low or No cost**  
(short payback)



Improve  
building  
performance



Improved building  
systems efficiency and  
extended equipment  
useful life



Reduce  
maintenance cost



Provide  
appropriate  
training to O&M  
staff



Improve  
system  
reliability



Improve occupant  
comfort and  
productivity



# Implementation of RCx

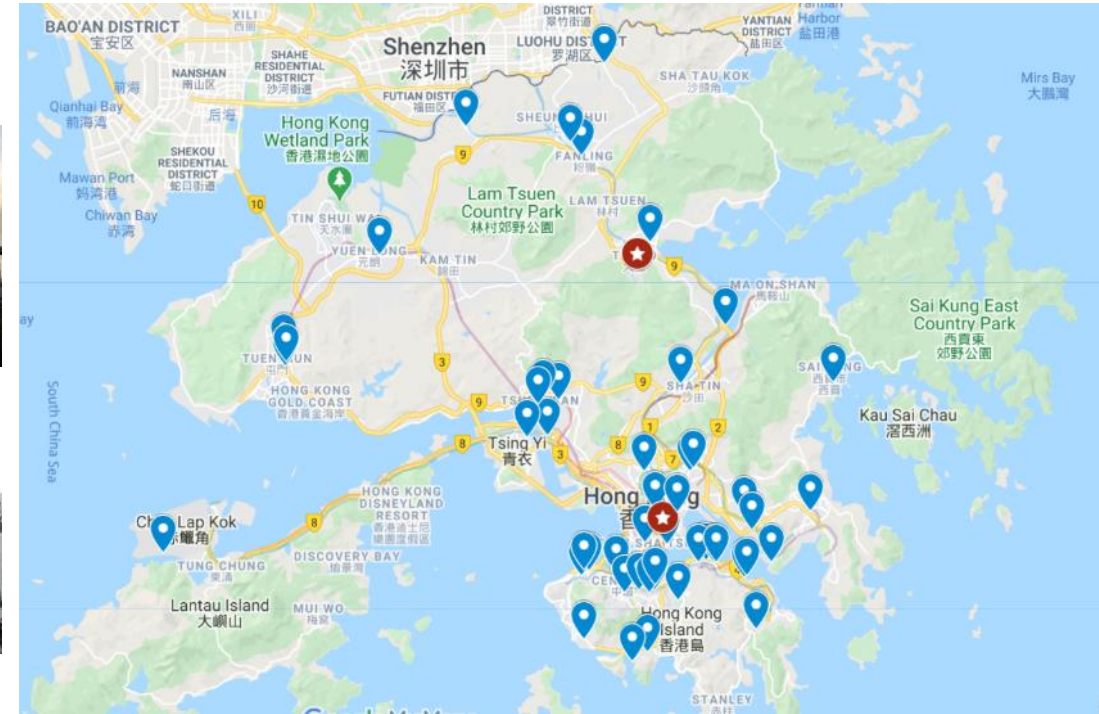
## Government Project



Over 200 nos.

7 years (since 2019)

1. Municipal Services Buildings
2. Government Offices
3. Swimming Pool
4. Town Hall
5. Public Library, etc.

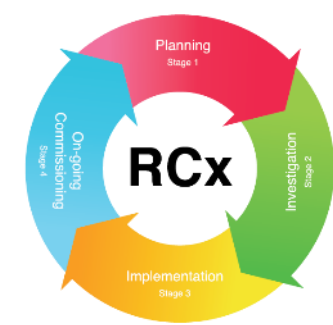






# Support for RCx

3

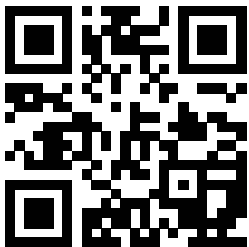


# Green School 2.0 for RCx – Talks & Workshops



Green Schools 2.0  
for RCx

Register NOW!



## PROFESSIONAL TALKS

Date: 11 Dec 2020 (Fri) (1 hour)

1. Introduction of use of operating data
2. Introduction of smart technologies to facilitate RCx

Date: 15 Dec 2020 (Tue) (1 hour)

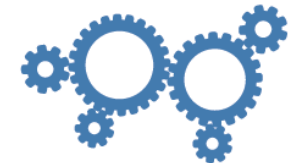
1. HKGBC RCx Training and Registration Scheme
2. Utilities funding scheme



## WORKSHOP CUM SEMINARS

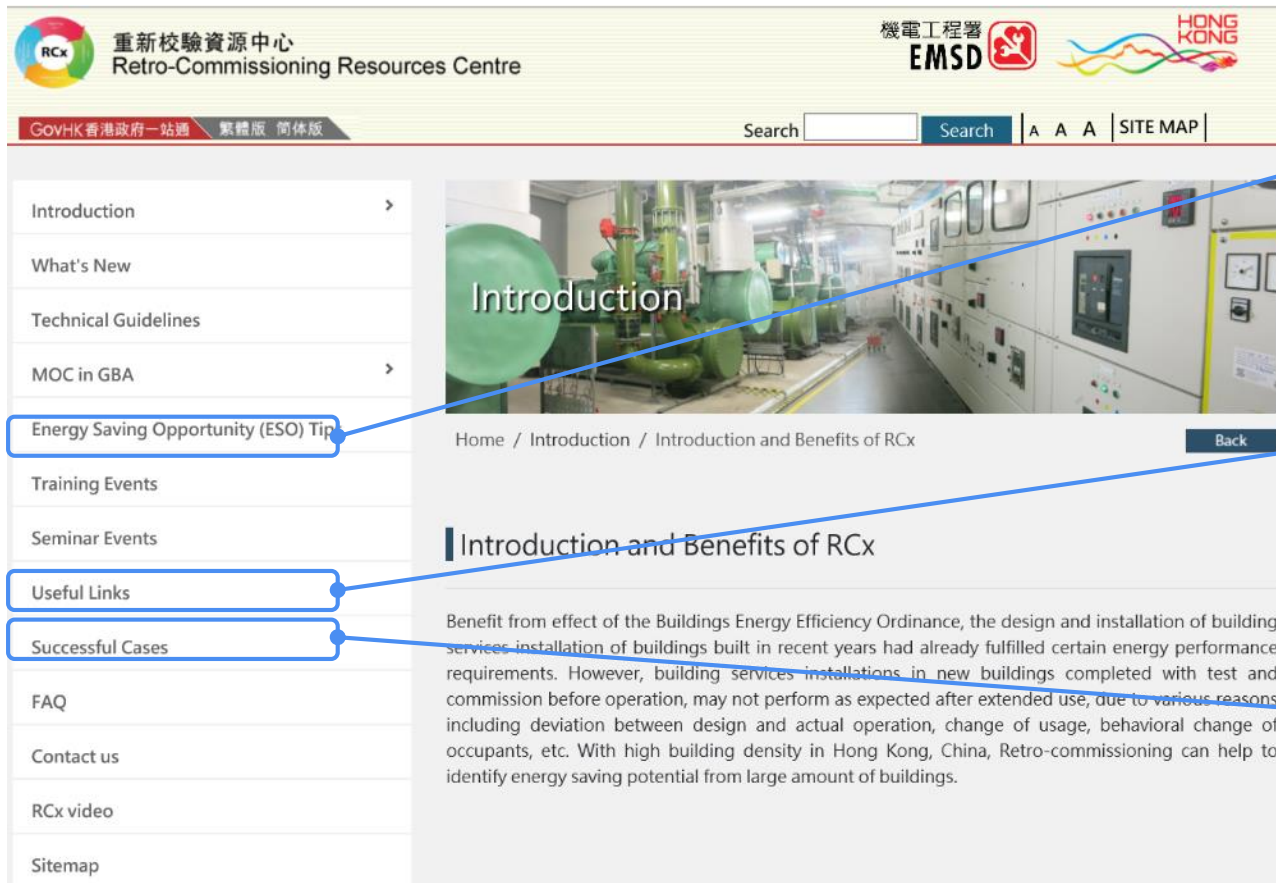
Date: 4 Feb 2021 (Thu) (1 hour)

1. Online demonstration video
  - RCx site evaluation
  - Implementation of energy saving measures, measurement and verification process
2. RCx services and products sharing
3. Q&A





# RCx Resources Centre



重新校驗資源中心  
Retro-Commissioning Resources Centre

機電工程署 EMSD HONG KONG

GovHK 香港政府一站通 繁體版 簡體版

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Technical Guidelines

MOC in GBA >

Energy Saving Opportunity (ESO) Tip

Training Events

Seminar Events

Useful Links

Successful Cases

FAQ

Contact us

RCx video

Sitemap

Introduction

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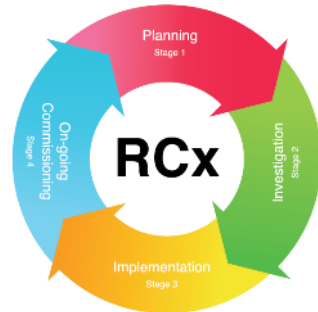
## Introduction and Benefits of RCx

Benefit from effect of the Buildings Energy Efficiency Ordinance, the design and installation of building services installation of buildings built in recent years had already fulfilled certain energy performance requirements. However, building services installations in new buildings completed with test and commission before operation, may not perform as expected after extended use, due to various reasons including deviation between design and actual operation, change of usage, behavioral change of occupants, etc. With high building density in Hong Kong, China, Retro-commissioning can help to identify energy saving potential from large amount of buildings.

Energy Saving Opportunity (ESO) Tips

Useful Links

Successful Cases



<https://www.rcxrc.emsd.gov.hk>

# Energy Saving for All – Awards & Results

## Awards & Results



AWARDS (ORGANISATION CATEGORY)	
Award	Name of Organisation
Hanson Grand RCx (Implementation) Award	Electric Tower
Outstanding RCx (Implementation) Award	One Island East
	One, Two Three Exchange Square and the Forum
	Pacific Place
Outstanding RCx (Proposal) Award	Gateway II
	Great Eagle Centre
RCx Continuous Enhancement Merit	Towngas Headquarters Building
	Lippo Centre
RCx Special Challenge Merit	Belilios Public School
RCx Technical Approach Merit	Three Garden Road
RCx Merit Award	Cathay City
	Mikiki
	Ocean Centre
	Ocean Terminal Extension
	Sun Hung Kai Centre





The Environment Bureau and the Electrical and Mechanical Services Department jointly organized the "Energy Saving Championship Scheme 2019" through application of innovative ideas and technologies, the energy saving and conservation in buildings in the community are targeted to be further enhanced. There are two categories of the Championship Scheme this year: the organisation category and the student category. The organisation category is to encourage concerted efforts of organisations in different sectors to adopt "Retro-commissioning" (RCx) as a cost effective measure to enhance energy efficiency of existing buildings. The student category is to inspire the creativity of young people in energy saving and the application of renewable energy.

The response was overwhelming, with over 80 applications and over 200 applications respectively from organisations and students.

<https://www.energysaving.gov.hk/eschampion2019/en/awards/index.html>

**JUDGING PANEL**

Organisation Category	Student Category
Legislative Council	Ir Dr Hon WK LO (Chairman)
The Hong Kong Institution of Engineers - Building Services Division	Ir Brian WL CHENG
Chartered Institution of Building Services Engineers (Hong Kong Branch)	Ir Dr Raymond KL CHAN
American Society of Heating, Refrigerating and Air-Conditioning Engineers (Hong Kong Chapter)	Ir Jacky CL NG
Association of Energy Engineers (Hong Kong Chapter)	Ir Dr Conson KH YU
Building Services Operation and Maintenance Executives Society	Ir Chris TING
Hong Kong Association of Energy Engineers	Ir HO Sai King
Energy Institute (Hong Kong Branch)	Ir YEE Kwong Fai
LEAPS	Ir Ambrose CHEN
Hong Kong Green Building Council	Ir Colin CL CHUNG (Chairman)
The University of Hong Kong	Ir Prof Dennis YC LEUNG
City University of Hong Kong	Ir Prof Michael KH LEUNG
Hong Kong Productivity Council	Ir Raymond CL FONG
CLP Power Hong Kong Limited	Ir Eric PC CHEUNG
The Hongkong Electric Company Limited	Ir TC YEE
The Hong Kong and China Gas Company Limited	Ir Duncan WO WONG
LEAPS	Ms Kata KWOK

**Secondary and Post-secondary School Category:**

**Hanson Grand Award**  
**St. Stephen's Girls' College**  
 Install the "Save N More" to your tap, it can instantly heat water directly to a preset temperature. With a temperature-controlled valve at the outlet, water is released only after reaching a designated temperature. This can help reduce energy loss in tanks and pipes. In addition, water will not be wasted during temperature adjustment. The infra-red sensor installed in the tap or shower head allows water to flow only when necessary. Water consumption data recorded by its built-in water meter will be transferred via IoT to one's mobile phone app which facilitates the user to properly plan one's water usage. In addition, this device considers the use of wastewater to generate electricity for energy recovery.



**Primary School Category:**

**Hanson Grand Award**  
**PLK Dr. Jimmy Wong Chi-Ho (Tin Sum Valley) Primary School (Chan Hoi Chun)**



**AWARDS (ORGANISATION CATEGORY)**

Award	Name of Organisation
Hanson Grand RCx (Implementation) Award	Electric Tower
Outstanding RCx (Implementation) Award	One Island East
	One, Two Three Exchange Square and the Forum
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	Lippo Centre
RCx Special Challenge Merit	Belilios Public School
RCx Technical Approach Merit	Three Garden Road
RCx Merit Award	Cathay City
	Mikiki
	Ocean Centre
	Ocean Terminal Extension
	Sun Hung Kai Centre

**AWARDS (STUDENT CATEGORY)**

Award	Secondary and Post-secondary School Category	Primary School Category
Hanson Grand Award	St. Stephen's Girls' College (Chang Wing Lum, Hung Dora Elaine, Leung Man Yi, Mo Ka Po, Wong Tsz Tung)	PLK Dr. Jimmy Wong Chi-Ho (Tin Sum Valley) Primary School (Chan Hoi Chun)
Hanson Outstanding Awards	City University of Hong Kong (Wan Ho Ching)	King's College Old Boys' Association Primary School No. 2 (Lee Cheuk Ip)
	Shun Tak Fraternal Association Yung Yau College (Cheung Wing Yin, Tong Wai Yan, Wong Tsz Yau)	PLK Horizon East Primary School (Chan Ting Hei)
	St. Teresa Secondary School (Chan Cheuk Yu, Chow On Yuet, Li Pui Yi, Ruk Gai)	St. Paul's Primary Catholic School (Cheng Ching Lam)
Hanson Merit Awards	The University of Hong Kong (Kwok Yu Ho, Zhang Yingguang)	St. Paul's Primary Catholic School (Tsang Hui Wing)
	City University of Hong Kong (Shek Hui Ying)	HRUGA Primary School (Melissa Chee)
	HRUGA College (Chau Man Shan, Chan Hoi Lai Kunda, Lee Tsz Hoi, Leung Wing Kai)	HRUGA Primary School (Edkoff Veronica)
Outstanding Participation School Awards	City University of Hong Kong	PLK Camden Tan Shu Lin Primary School (Choi Cheuk Hin)
	St. Teresa Secondary School	PLK Horizon East Primary School (Yim Wai Pok)
	City University of Hong Kong (Shek Hui Ying)	S.K.H. Tsung Kwan O Kai Tak Primary School (Ip Yan Yu)
Best Presentation Award	St. Teresa Secondary School (Chan Cheuk Yu, Chow On Yuet, Li Pui Yi, Ruk Gai)	St. Matthew's Lutheran School (Saw Mau Ping) (Cho Nga Ching)
	St. Teresa Secondary School (Chan Cheuk Yu, Chow On Yuet, Li Pui Yi, Ruk Gai)	St. Matthew's Lutheran School (Saw Mau Ping) (Leung Ka Ching)
	St. Teresa Secondary School (Chan Cheuk Yu, Chow On Yuet, Li Pui Yi, Ruk Gai)	St. Paul's Primary Catholic School (Pang Cheuk Lam)
Best Potential Award	City University of Hong Kong	Tai Koo Primary School (Chau Wai Kiu, Atta)
	St. Teresa Secondary School	Tai Koo Primary School (Lam Wing Ki, Rachel)
	City University of Hong Kong (Shek Hui Ying)	PLK Horizon East Primary School
		St. Matthew's Lutheran School (Saw Mau Ping)

# What Have Been Done?



Air Handling Units (AHU)  
supply and return air  
temperature reset



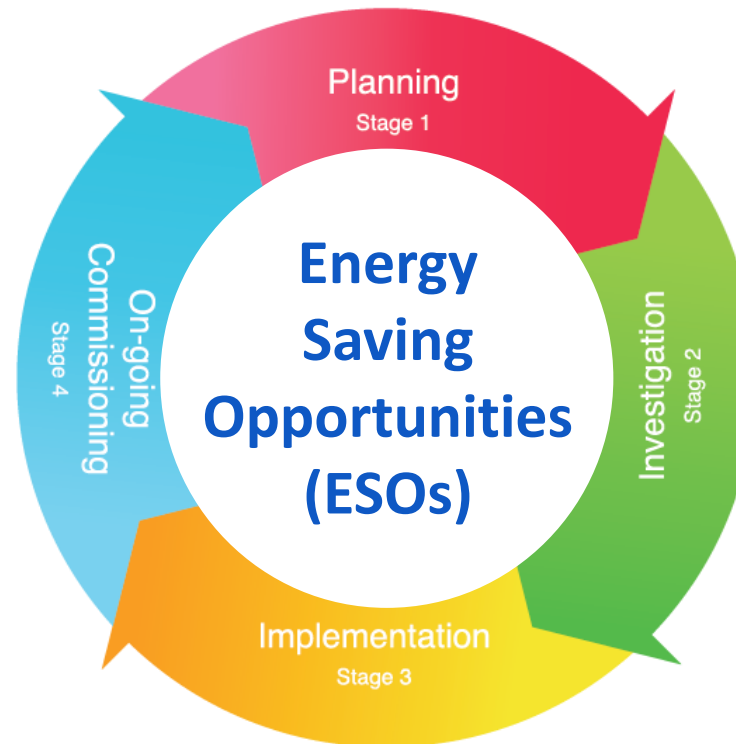
AHUs  
Static pressure reset



Use of photocell and  
occupancy sensors



Use CO sensor for  
demand ventilation of  
carpark



Optimisation of quantity of  
operating chilled water pumps by  
the lowering the operating frequency



Optimisation of chiller plant  
secondary pumps in decoupler  
system  
(Primary and Secondary Chilled  
Water flow Balancing)

# What Have Been Done?



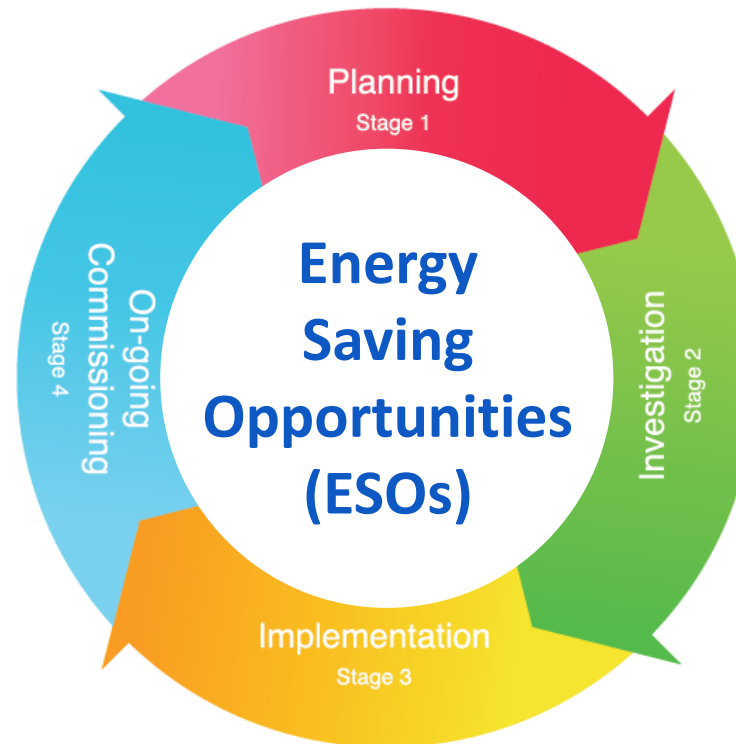
**Upgrade** of the aged air-cooled chilled water plant to water-cooled



**AI-based system** for data collection, analysis and system control



**BMS** for chiller plant data collection, analysis and system control



Use **Variable-speed-drive (VSD)** control for air-side and water-side equipment (AHUs/ Pumps/ Fans, etc.)



Use of **EC plug fans** for AHUs



Lift modernization with **Variable Voltage Variable Frequency (VVVF)** system



**... and MORE!**

[www.energysaving.gov.hk/eschampion2019/en/awards/index.html](http://www.energysaving.gov.hk/eschampion2019/en/awards/index.html)

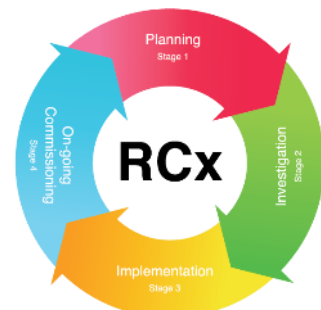


# RCx Training and Registration Scheme

- Launched in 26 November 2019
- Organised by HKGBC
- Supported by EMSD and different professional bodies
- 3 tiers of practitioners:-
  - RCx Practitioner Level 1
  - RCx Practitioner Level 2
  - RCx Professional



15 Dec 2020 (Tue)



# Utilities Funding Schemes

## Eco Building Funds 綠適樓宇基金



### Eligibility Buildings

- Residential Buildings
- Commercial Buildings
- Industrial Buildings



### Energy Efficiency Enhancement Projects

- Retrofitting of building services installations
- **Retro-commissioning**
- **Building-based smart technologies**



15 Dec, 2020 (Tue)

# Utilities Funding Schemes

## Smart Power Building Fund (SPBF) 智「惜」用電樓宇基金



樓宇基金  
BUILDING  
FUND



### Eligibility

#### Buildings

- Residential Buildings
- Education, Welfare & Community Organisations
- Commercial and Industrial Building



#### Energy Efficiency Enhancement Projects

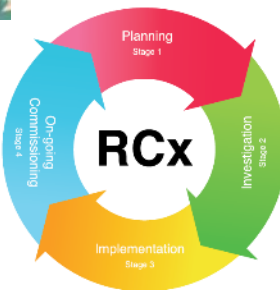
- Retrofitting of building services installations
- **Retro-commissioning**
- **Building-based smart technologies**



15 Dec, 2020 (Tue)



**Let's work together to save energy**





A wide-angle aerial photograph of Hong Kong, showing the dense urban landscape of the Kowloon Peninsula in the foreground, the Victoria Harbour in the middle ground, and the New Territories in the background under a clear blue sky. The text "Thank You" is overlaid in a large, white, sans-serif font on a semi-transparent grey rectangular background in the center of the image.

# Thank You